

REPRODUCTIVE BEHAVIOR OF HAIRY WOODPECKERS

I. PAIR FORMATION AND COURTSHIP

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THIS report concerns the breeding behavior of Hairy Woodpeckers (*Dendrocopos villosus*) which I have studied from 1957 to 1965 in Seneca, Maryland, and later, and to a greater extent, in Tamworth and Lyme, New Hampshire, from its onset in midwinter until separation of parents and young in midsummer. I have been in the field observing these birds on nearly every day of the year for the last two years. It has become apparent in these studies that Hairy Woodpeckers exhibit much individuality in behavior, a situation first noted in Maryland where a female did an extraordinary amount of drumming in fall, winter, and spring months (Kilham, 1960). Comparisons of observations between Maryland and New Hampshire suggest that there may be regional differences in behavior patterns in the two areas. The activities of this species are unusual in a number of ways. One is that the female occupies the breeding territory in the fall and it is the male which comes to her at the onset of the breeding season, and another, a readily recognizable difference in feeding habits between males and females which I have described elsewhere (Kilham, 1965). The present report concerns pair formation, courtship, nest site selection, and subsequent papers will treat nesting and agonistic behavior in relation to habitat.

METHODS OF COMMUNICATION

The terms vocalizations and displays are used separately below for convenience of presentation, although display is more generally used as a term including both vocal and nonvocal performances.

Vocalizations.—(a) *Speak*. This is a common note of *D. villosus* in all months of the year. It expresses mild excitement, as when a Hairy Woodpecker, scared from a feeding place, waits impatiently to return. Single *speaks* act as location notes on other occasions. Some Hairy Woodpeckers give repeated, shrill *speaks* which suggest the piping notes of a Robin (*Turdus migratorius*) when an intruder approaches the nest.

(b) *Whinny*. A series of *haan*, *haan*, *jer*, *jer* or other variations of uniform notes given so rapidly that they almost run together. I have heard these vocalizations rarely in fall and early winter months. They become more frequent in spring, especially as the young develop. Juveniles and their parents use whinnies in keeping in touch with each other.

(c) *Sputter*. This is given in situations of alarm during the breeding season, as when parents are excited near a nest with young. It has elements of a whinny, but is loud and sharply varied with versions such as *chip-cha-*

haa-haa or *chrr-charr-jer-jer*, a kind of lilting, sardonic laughter, well drawn out.

(d) Greeting notes. The members of a pair which have been separated for a time may greet each other on rejoining with exuberant notes ranging from a rapid *queek*, *queek*, *queek*, to *chewi*, *chewi*, *chewi*, *woick*, *woick*, *woick*, or *joick*, *joick*.

(e) Intimate notes. Low *teuk*, *teuks* and other variations are exchanged or given by the female alone when coming into the proximity of her mate or moving out on a limb, inviting him to follow in copulation.

(f) Conflict. Males or females in conflict may give especially shrill *queek*, *queek*, *queek* notes or occasionally a *wick-a-wick-a-wick* which sounds not unlike a vocalization of flickers (*Colaptes auratus*).

(g) Vocalizations of nestlings. Young Hairy Woodpeckers can remain silent in the nest but usually break into a steady, rapid *click*, *click*, *click* against an even background of other sound at the approach of a parent. The notes become harsh and mechanical when an adult reaches the entrance with food. As I have found with captives, nestlings can also make cheerful, chirpy-chittery vocalizations and a contented *pee-purp-pee-purp* when settling down to sleep after being fed. Sudden fright sets off surprisingly harsh, pulsating notes heard on no other occasion.

Vocalizations of parent and young Hairy Woodpeckers may have regional variations. In New Hampshire but not in Maryland I have heard a pleasant *brrrrrrr* which sounds like a tree toad (*Hyla versicolor*) used when a parent approached young with food. Two hand-raised individuals greeted me in this fashion during their first summer in an aviary.

Drummings.—Hairy Woodpeckers communicate a range of meanings with their drummings which may vary from four to 11 or more bursts a minute depending on emotional intensity. The male usually drums more than the female, but she may do a considerable amount of drumming. One female, previously described (Kilham, 1960), drummed far more than her mate.

(a) Calling for a mate. The members of a pair may roost at a distance from each other and the male, instead of going in search of his mate, usually drums until she joins him. She may drum for him at other times of day when they have been separated.

(b) Drumming for copulation. A male, when at a peak of readiness for copulation in late April or early May, will drum for half an hour or more if needed to attract his mate, if she is not in the vicinity. Copulation usually follows shortly after she returns. Females may also drum for copulation or pseudocopulation earlier in the season.

(c) Location drumming. When a female, sought by her mate, returns from a distance, she may announce where she is by a low burst of drumming.

The male stops drumming immediately, but may resume after a few minutes if she comes no closer.

(d) Duets. Hairy Woodpeckers form pairs in midwinter nearly 3 months before they nest in late April. Among activities strengthening the pair bond during this period are duets of drumming, in which a burst from one stimulates a burst from the other. Such duets may continue for 15 or more minutes over a distance of 100 yards, with either sex taking the lead. Duets occurring later in the season are usually of a different nature. In these the drumming can be intense and prolonged when the male favors one nest site and his mate another.

(e) Territorial drumming. This is done primarily by the male on a tree opposite to the territory of an adjacent pair. He appears to seek or to be responding to a challenge of the opposite male to have an answering duet. The female does relatively little of this type of drumming in late winter when males are most active, but may do a good deal in fall months when establishing her territory alone.

(f) Demonstrative drumming. A woodpecker may start drumming intensively on whatever indifferent place it happens to be in response to an avian intruder in the vicinity of its nest or roost hole.

(g) Miscellaneous drumming. It is not always possible to assign a reason for drumming. A Hairy Woodpecker may rest on a bare limb in full sunshine, drumming now and then while preening, for what may be just the pleasure of doing so.

Tapping.—A Hairy Woodpecker of either sex searching for a nest site may percuss as it moves up a tree trunk or drum a burst here and there. When it locates a place seemingly suitable for a nest excavation it taps at a countable rate of two to three taps a second, thus communicating interest in a definite spot to its mate, who may be enticed to fly over to inspect. Tapping may be done sporadically at times of changeover in the work of excavating later on.

Wing ruffle.—Hairy Woodpeckers can fly silently or make a loud *brr* in flight. This *brr* is generally expressive of disturbance or excitement but can also act as a location noise when an individual, for example, is leaving its mate or attendant juvenile to fly elsewhere.

Displays.—(a) Crest-raising. Done by itself or accompanying other displays. It indicates interest or excitement.

(b) Bill-waving. A Hairy Woodpecker in conflict with a member of its own sex may jerk its body about, half-start its wings, and wave its bill like a baton, with head held somewhat backward and tail outspread (Kilham, 1960). This display is also used against nonspecific competitors such as Starlings (*Sturnus vulgaris*).

(c) Frozen pose. An individual may freeze with body flattened against a

tree trunk and bill pointed straightforward when anticipating an attack from a rival or a passing predator.

(d) Resting motionless. Members of a pair may cease all activity and remain motionless within sight of each other for 5 or more minutes when in close accord, either by a nest hole in process of excavation or even in midwinter prior to some act of courtship, such as precopulatory behavior. For such active, energetic birds, these sudden motionless periods are a striking form of behavior.

(e) Courtship flight. An irregular type of flight, either fluttering and bat-like, or floating, is occasionally observable at moments of emotional intensity, as when a Hairy Woodpecker is approaching its mate, its nest, or a symbolic nest site earlier in the breeding season.

(f) Full-wing threat display. An individual may hold its wings at a 45 degree or greater angle over its back when attacked in conflict or even assume the pose when in the air and floating in to alight on a tree where a rival is waiting. A single Hairy Woodpecker, after emerging from its roost hole, may perform in similar fashion when dodging around a tree trunk in play against an imaginary enemy.

Ceremonies.—(a) Symbolic nest site. A female Hairy Woodpecker in January or February may alight below a branch stub on a decadent aspen (*Populus tremuloides*) and drum, sometimes in prolonged fashion, until her mate approaches, when she will immediately start to tap. If he flies toward her, she may leave in courtship flight, leaving him to alight where she had been. Such trees are nearly always aspens, unsuitable for actual nest holes, and no excavations are attempted. The same tree may be used on many successive mornings.

(b) Pantomime of copulation. A female may suddenly fly to the vicinity of her mate in midwinter giving *teuk, teuk* notes and alight on a limb 1½–2 inches in diameter and 3 feet or so from the tree trunk, to assume a cross-wise position inviting copulation. Her mate may show no response, move close then leave, or actually mount in a semblance of full copulation (Fig. 1) a month or two before fertilization could, expectedly, take place. Precopulatory behavior plays an important role in courtship behavior. I have not observed courtship feeding in *D. villosus*, but this appears to serve much the same function.

Hairy Woodpeckers communicate in more ways than indicated above, since variations of tone and pattern, as well as of associated displays and the nature of attending circumstances, add to the range of meanings conveyed by their vocalizations, drummings, and displays. This larger context of communications among birds has been well described by Smith (1963).

Figure 2 summarizes the various displays and activities of Hairy Wood-



FIG. 1. Hairy Woodpeckers (male above) in full copulation.

peckers in relation to the time of their use or occurrence within the entire breeding season.

PRE-BREEDING SEASON ACTIVITIES

Male and female Hairy Woodpeckers pay little attention to each other in fall months in New Hampshire when leading independent lives. Thus, of 43 times I encountered individuals on mornings from September through November 1963, they were together as pairs on only four occasions, of which three were in September. The woodpeckers exchanged *chewi* notes when at all close as they moved through the woods in brief association.

In December 1963 I observed a male and female which had roost holes 50 feet apart (see Fig. 3) and often greeted each other on emerging in the morning. On 15 December the male MA flew to where the female FB was feeding and displaced her. She moved away a few feet giving *teuk, teuk* notes. Since she gave these intimate notes not infrequently, I wondered whether these two birds might not form a pair later on. FB, however, was roosting within her breeding territory and MB, her mate of the previous year, began to appear in the vicinity of her roosting place as early as 24 December. Peaceful at first, he became increasingly aggressive toward MA until FB went to roost elsewhere on 24 January 1964. MA continued to roost in the same place until

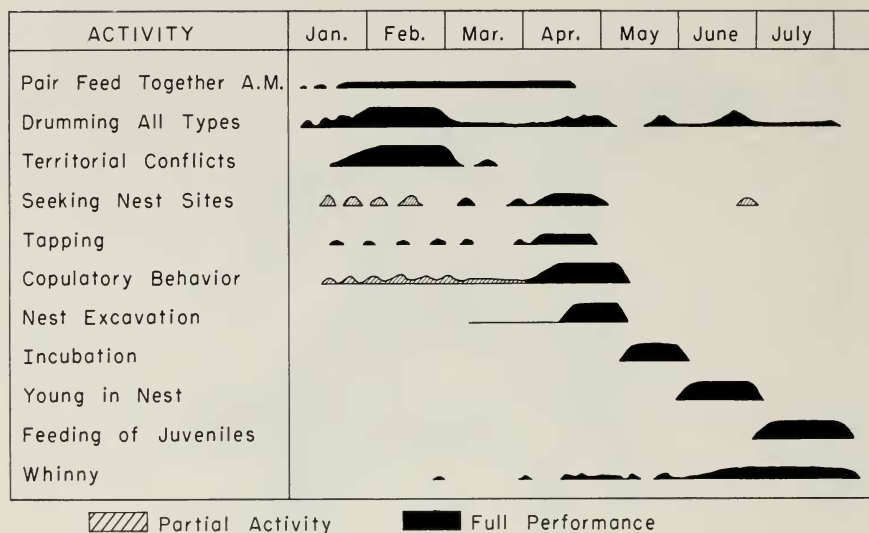


FIG. 2. Diagrammatic summary of displays and activities of Hairy Woodpeckers in the breeding season.

March, flying each morning to the adjacent territory of FA (Fig. 3) to whom, I believed with less evidence, he had been mated the year before.

EARLY BREEDING BEHAVIOR

The breeding activities of Hairy Woodpeckers do not represent a continuous development, but rather occurs in successive phases. These are used to facilitate the descriptions given below.

Phase I.—Mid-January to early March was a period of pair formation, courtship, and territorial conflicts. (The agonistic behavior of Hairy Woodpeckers, however, as observed on a year-around basis, will be the subject of a subsequent report.)

Activities of a well-established pair.—The close harmony between the members of Pair B, which were together for at least three breeding seasons, was reflected in the following episodes:

(a) Symbolic nest tree.—At 8:00 AM on 10 January 1965 FB flew to an old aspen and rested motionless for 20 minutes below the stub of a broken branch. Her mate, MB, rested equally motionless 70 feet away. When FB broke the silence by tapping four sets of four to five taps each, he moved closer and drummed for 7 minutes at a rate of four bursts a minute. FB tapped in a prolonged manner as her mate came within 20 feet. She then flew away. The aspen trunk where she had rested for 30 minutes was too narrow and too decadent to have made an actual nest site.

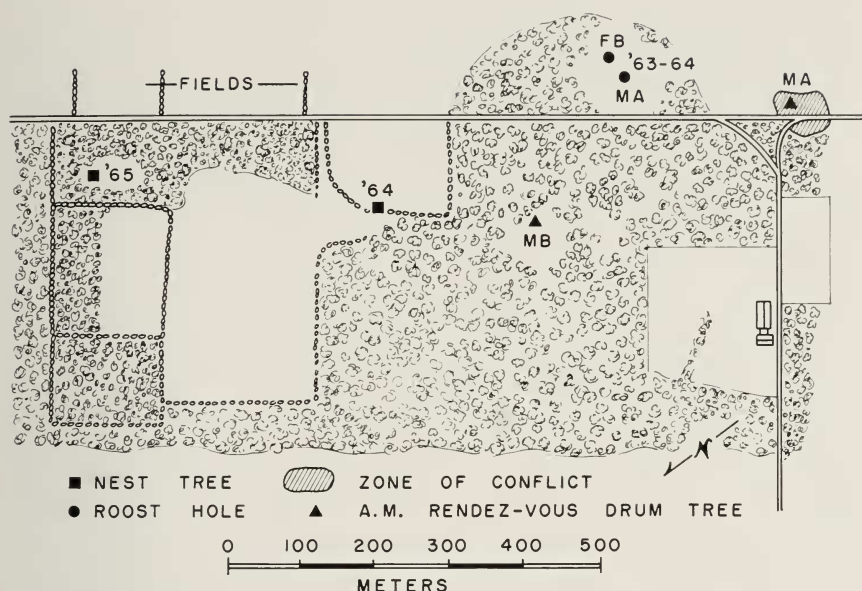


FIG. 3. Map of the breeding territory of Pair B Hairy Woodpeckers showing locations of nest, roost, and drumming trees.

The activities involved, however, appeared to bring the two birds together again, after months in which they had lead separate lives.

(b) Copulatory behavior.—MB started drumming on a dead aspen at 7:20 AM on 8 February 1964 while FB was feeding in woods below. After a few minutes she flew to him in fluttering flight, giving *teuk* notes, and alighted on a branch in a precopulatory pose. MB became silent and motionless, then flew away.

A more complete performance took place on 29 February when FB drummed a few bursts, then flew to her mate as before. This time he mounted and fell off gradually to the left in what appeared to be full copulation (Fig. 1) two months prior to actual nesting.

(c) Beginning of a nest excavation.—On 3 March 1965 MB began an excavation which he continued to work on sporadically until late in April. It never became more than a perfect entrance, since the underlying wood was too hard. The tree was a special one in the lives of the two woodpeckers, however, since the pair had not only made a similar abortive excavation here in 1964, but were to make their actual nest hole in it in 1965, 5 feet below the entranceway begun in March. This situation appeared to reveal that the members of this pair had time to spare. Being well adjusted both to each other and to their territory, the fashioning of the entranceway in leisurely fashion became a mutual enterprise, serving as an outlet for their not as yet

fully developed instincts for actual nesting. They had no need for the extensive drummings and flights back and forth of neighboring pairs. Such activities were nearly always indicative of efforts to reach equilibrium in what to the woodpeckers involved were either new situations or ones which, for some reason, were not complete. A key feature in the habitat for these birds is a suitable nest tree. Harmony or continued disturbance between members of a pair usually hinges on its presence or absence and ideal trees can be few and far between.

Activities of newly formed or less well established pairs.—FA retained the same breeding territory but had different mates in each of two successive years. Her two mates had quite different characters. MA in 1964 lacked zeal, both for territorial conflicts, in which he was always pushed around, and in courtship, as shown by frequent failures to respond in full to his mate's signals. MA' in 1965, on the other hand, was more average. He fought hard for the limited time needed to establish the territorial boundary and he appeared to want a close pair bond as much as his mate. The experiences of FA with her two contrasting mates were as follows:

(a) Pair formation.—The first time I encountered MA' was when he was drumming at the top of a tall, dead pine on the morning of 22 January 1965. Then I heard an answering drum from FA some distance away. MA' immediately started flying in her direction by way of successive trees, on which he stopped to drum and listen. It thus appeared that she was attracting him to her breeding territory.

(b) Symbolic nest tree. On the early morning of 26 January 1964 MA drummed in a leisurely fashion of four bursts a minute on a dead roadside aspen. The exact location, below a branch where the trunk was 6 inches in diameter, was suggestive of a nest site, but too decayed to offer any real possibility. FA drummed on the same spot on 8 February. When he approached, she tapped, then flew away with exuberant *teuk, teuk* notes. More or less similar performances took place in succeeding weeks, with MA showing increasingly less interest. On 15 February, for example, FA drummed four times a minute on the aspen and when MA came 100 feet along the road, she stopped and rested. When he started to move away, she began drumming again. MA now idled about without coming closer until she finally gave up drumming after a half hour of trying to attract him to what was little more than a demonstration of the pair bond. She kept up her performances on the aspen until early March. On some days, as on 24 February, she would finally fly to MA, who still paid little attention, while she held a strained pose or resorted to displacement pecking.

Her mate of the following year was far more responsive. On 31 January 1965 FA drummed on the same place on the aspen as in 1964, although the

trunk had meanwhile broken and was leaning against another tree. She subsequently adopted another aspen farther down the road. When she started to tap here on 4 March, with bursts of four to 12 taps each, MA' flew to her in courtship flight giving exuberant *chewk*, *chewk* notes. She left in a similar flight as he alighted where she had been.

(c) Drumming.—MA made contact with his mate each morning not by looking for her but by drumming on a high, dead branch of a sugar maple, his rendezvous tree (see Fig. 3), until she gave some response, usually by drumming on her aspen. Duets between the two might last for 15 minutes. The fact that the members of this pair were not well adjusted seemed to explain their excessive amounts of drumming, far more than I had encountered with eight other pairs which I followed in Lyme in 1964 and 1965.

The drumming of Male C, who appeared to be without a mate for a period in mid-February, differed from that of Pairs A and B, which used moderate rates of four to five bursts a minute. On 12 February 1964 he drummed for a prolonged period at eight bursts a minute. Three days later, however, MC drummed at an extraordinarily fast rate of 26 bursts a minute, from 70 feet up in the same maple.

Phase II.—The period of early March to early April was a lull of less active courtship between the earlier period of border conflicts and the subsequent one of preparation for nesting.

(a) Drumming.—Pair B, which behaved harmoniously through two breeding seasons, was comparatively quiet. It was nearly the end of March before MB settled on an indifferent black cherry stub, low down and partially surrounded by trees, as his rendezvous drumming place (see Fig. 3). He drummed here solely to attract his mate in the early morning. On 4 April 1964, for example, MB had drummed for 10 minutes when FB approached with a *brr* of wings. He immediately stopped and waited. When she came no closer, he drummed again, and she flew to him with *queek*, *queek* notes, alighting close by in a precopulatory position. Having apparently obtained these indications of responsiveness on the part of FB, MB flew off and she followed shortly afterward. MB used the same drum tree, in similar fashion, in the following year.

The unusual amount of drumming carried on by Pair A in February continued in even greater degree in March 1964, a fact which made the two birds easy to locate on early mornings. Their drumming had now shifted to a lumbered area with tall, mast-like, dead pines, and now had the appearance of being largely play. Thus one, then the other, might take the lead in leisurely duets which might end when FA flew to the pine where MA was drumming and took his place, as he flew away in courtship flight. She would then drum

on the spot where he had drummed, only to be replaced by him a little later. MA did the larger part of the drumming. The awareness of his mate to what he was doing, even when feeding out of sight and at a distance, was illustrated by an episode on 30 March. She was working on a fence post under a canopy of pines. When MA stopped drumming 100 yards away and flew off with a *brr* of wings, she immediately lifted her head to give shrill *queek, queek, queeks*, then continued her work.

FA did far less drumming with her new mate MA' in March of the following year. On 16 March 1965, however, I found her drumming in prolonged fashion on one of the mast pines while MA' fed in woods below in seeming unconcern. When she stopped, he flew up, then moved out on a short limb where she had assumed a precopulatory position, and the two nearly touched bills. There had been almost none of this type of behavior between FA and MA in the previous year.

(b) Copulatory behavior.—Eight days after the above episode on 16 March, MA' tried to mount FA under similar circumstances, but she swung under a limb at the last moment. Copulatory behavior was minimal in this period as compared with earlier months when territorial conflicts had been at their peak. There is a not infrequent association between the two forms of behavior. Although conflicts were few in Phase II, Males E and F did have a sharp bodily encounter on their mutual boundary on 13 March 1965, following which ME flew directly to FE, who moved out on a limb giving a frog-like quaver as well as *teuks*. He mounted in full coition. It appeared as if the high emotional tone engendered by the clash had carried over without a pause into sexual behavior.

(c) Excavations.—The very early location of a nesting tree by Pair B in 1965 probably reflected the fact that the two woodpeckers, together for at least 3 years, were closely adjusted both to each other and to their territory. On 31 January, for example, I was able to locate MB by the sound of his tapping. He gave repeated bursts of four to five taps on a live aspen with a rotten center where, as described for Phase I, he started a nest entrance on 3 March. I continued to watch him for the remainder of the month. This was fairly easy, for he usually did his excavating in leisurely fashion in the middle of the day, with pauses to rest and preen in the sun. FB did little of this early excavating. On 13 March, however, she did work for 17 minutes at the hole, which was deep enough for her to get her head inside. It was not much deeper when abandoned in late April.

(d) Feeding together.—A further expression of the closeness of bonds between members of pairs of Hairy Woodpeckers was that they usually fed not far from each other as they moved through woods on early mornings from January through April.

Phase III.—A period from early April to early May of nest site selection, excavation, and increasing copulatory behavior. The first of these activities was much the same as for the symbolic nest sites of Phase I, but the trees involved were sound enough to be good prospects. I witnessed a typical example of the search for a site on 13 April 1960 when I heard slow, irregular, but prolonged tapping in the woods at Tamworth. I then located a female tapping just below a fresh, oval-shaped hole in a maple stub. She would tap, then rest motionless. When her mate finally came to inspect, she flew off giving *jeeks*.

(a) Excavating.—Hairy Woodpeckers excavate throughout the day with the male doing the larger part of the work, especially in forming the entrance and upper part of the cavity. Sawdust is tossed from the hole directly. Occasionally, however, as exemplified by ME on 28 April 1963, a male may wriggle out from his nest hole with a bill full of sawdust, then fly to a tree trunk 30 or more feet away to shake it loose. Since nest sanitation at a later date follows the same pattern, it is possible that the sawdust maneuver represents the awakening and trial of a form of instinctive behavior before it is actually needed. Similar behavior occurs among other woodpecker species, including Yellow-shafted Flickers (*Colaptes auratus*) and Yellow-bellied Sapsuckers (*Sphyrapicus varius*) (Kilham, 1959a, 1962a).

On 1 May 1965 FB exhibited an aberrant form of excavating when she flew from her excavation 10 times in succession to discard sawdust 40 feet away. While this type of sawdust removal is not characteristic of woodpeckers, it does occur among other members of the Piciformes, as I have observed for the Double-toothed Barbet (*Lybius bidentatus*) in East Africa.

(b) Display flights.—Pair H, in Tamworth in 1961, had an excavation 13 feet above the ground in a maple next to the house and separated from woods by 30 yards of open lawn, a situation favorable for observation of flights to and fro. FH might fly from the woods with short, quivering wing strokes, making *joick, joick, joick* notes, alight on a limb of the maple, then float down to the nest entrance on outstretched wings. MH would then wriggle out, leaving her to excavate. He sometimes flew off in fluttering flight or even circled about the lawn in a similar manner before entering the woods.

(c) Copulatory behavior.—I followed Pair F for an hour early on the morning of 16 April 1963 as the two birds moved through woods in Lyme, feeding in loose association. At 7 AM, when their circular course had brought them back by their excavation in a hop hornbeam (*Ostrya virginiana*), FB gave *teuk* notes and elevated her tail. Full copulation followed. I found FF at her excavation again 3 days later. She tapped a few times, rested motionless for 10 minutes, then flew off in fluttering flight accompanied by

queeks. I now followed the pair, from 6 to 7 AM, as they fed through the woods. The male took the lead in each of two copulations during this time, once by simply approaching FF from below on a tree trunk and, on the second occasion, by drumming a few bursts, then flying to her. By the last week in April MF was working up to 40 minutes at a stretch excavating in the horn-beam. He now took the lead in all copulations. Since the two woodpeckers were no longer feeding together, he had to drum for her to come when he was ready, as exemplified on 28 April. On this morning MF drummed loudly on an oak near the excavation, looking all about as he did so. I then heard a low answering drum. Ten minutes of silence followed. FF then began to give *teuk* notes and MF glided down to copulate. Two copulations observed on 2 May were likewise close to the excavation and were preceded by similar performances. It was on this date that MF spent his first night in the nearly completed nest hole.

Copulations of Pair B followed a pattern which differed somewhat from that described above. Thus MB had just spent his first night in his new nest hole on 2 May 1965 and was looking out at 5:45 AM when FB began a loud drumming, 200 yards away. He then flew out to move toward her slowly from tree to tree, giving a few low drums in reply. She moved out on a limb as he approached and copulation occurred. The two birds then separated to feed. At 6:03 AM, however, MB returned to drum on exactly the same place where FB had drummed previously, then became silent as she flew in. Copulation with close cloacal contact followed, for the second time within 15 minutes. Incubation for Pair B was well under way 4 days later.

DISCUSSION

The striking feature of the early breeding behavior of Hairy Woodpeckers is that their courtship is a lively affair carried out with an exuberance and closeness of the pair bond expressed by varying combinations of displays, intimate notes, and copulatory activity. All of these patterns of behavior are in marked contrast to those of the related Downy Woodpecker (*Dendrocopos pubescens*) observed under similar circumstances (Kilham, 1962*b*). One might suppose on first approach that similarities in plumage of these two species, as well as in their principal forms of vocalization and display, would mean similarities of breeding behavior as well. Yet little closeness of the pair bond was apparent, even with a hand-raised pair of *D. pubescens* which bred and incubated eggs for two successive years in an aviary (Kilham, 1962*b*). The usual greetings of the two birds was limited to a harsh chirp. Hand-raised Hairy Woodpeckers, on the other hand, appeared to enjoy not only the company of each other, but also of those who cared for them, coming

to the wire with outbursts of intimate vocalizations as if greeting one of their own kind.

The generalization of the Heinroths (1958) that many woodpeckers are not particularly fond of their mates may well apply to *D. pubescens*. Observations on other species, however, such as the Hairy, Pileated (*Dryocopus pileatus*), and Red-bellied (*Centurus carolinus*) woodpeckers, as well as Yellow-shafted Flickers (Kilham, 1960, 1959b, 1961, 1959a), indicate that they form close pair bonds, expressed by a variety of vocalizations and displays. While *D. pubescens* is the smallest of this group, size bears no relation to closeness of pair bonds among birds. Red-breasted Nuthatches (*Sitta canadensis*) appear in present studies, for example, to be as attentive to each other in the breeding season as did large Black-and-White Casqued Hornbills (*Bycanistes subcylindricus*) (Kilham, 1956).

The role of females varies among woodpeckers. Thus, while female Hairy Woodpeckers occupy territories at the onset of the breeding season and attract the males to them (Shelley, 1933; Kilham, 1960), males among Red-bellied Woodpeckers and Yellow-bellied Sapsuckers (Kilham, 1961, 1962a) establish the breeding territories and take the lead in most activities, leading to actual nesting. The fact that the female of *D. villosus* is on familiar ground may give her an initial advantage psychologically. Her intimate notes, copulatory poses, and tapings at symbolic nest sites all suggest that she takes the lead in winter courtship, while her mate engages in territorial conflicts, then gradually adapts himself to his new situation.

The individuality of Hairy Woodpeckers has been evident in a variety of circumstances. One of these concerned a highly unusual female observed over fall, winter, and spring months in Maryland (Kilham, 1960) and another, differences in feeding habits between males and females observed in New Hampshire (Kilham, 1965). Individuality of this latter type may serve to improve utilization of the environment. From whatever cause it has arisen, however, it is possible that a long period of courtship, with mutual adjustments, may be what enables a species to tolerate wide degrees of individuality without endangering the close cooperation requisite for nesting success.

The extent of individuality doubtless varies among birds. Howard (1952), in her observations made on close acquaintance and in an absence of fear, found that Great Tits (*Parus major*) were more individualized than other species of tits (Paridae) as well as being more intelligent. She felt that the two attributes went together. This situation could hold as true for woodpeckers as for tits and it is of interest that Cobb (1960) found the brain of woodpeckers comparable to that of the Passeriformes in size and development.

Comparisons between European and American woodpeckers can be fruitful in alerting one to behavior patterns which might otherwise be overlooked.

The Great Spotted Woodpecker (*Dendrocopos major*) of Europe, for example, resembles *D. villosus* in a number of aspects of its breeding behavior (Kilham, 1960). It is ecologically more diversified, however, in guarding food stores within special territories in fall and winter months (Pynnönen, 1939) and in extracting seeds from pine cones (Blume, 1962). Pynnönen has further (1943) described local differences in which populations of *D. major* in Finland live primarily on plant food and ants and those in mid-Europe feed on beetles and beetle larvae. One should be alert for differences among local populations of *D. villosus*. Although these might be difficult to establish without larger numbers of observations, I have observed patterns of behavior in Maryland not encountered in New Hampshire. Among these (Kilham, 1960) were duet flights, also described for *D. major* by Pynnönen (1939), occurrence of breeding behavior in the fall, and a shyness comparable to that usually associated with Pileated Woodpeckers which made observation difficult. A further difference lay in size of breeding territories. These seem to become smaller as one moves south. This also may be true for *D. pileatus* (Kilham, 1959a) as well as for *D. villosus*, and is possibly due to more insect food being available over more months of the year in warmer climates.

Although Huxley (1942) considers the Great and Lesser Spotted (*D. minor*) woodpeckers "extremely similar in appearance and habits," anyone accustomed to the much closer plumages of Hairy and Downy woodpeckers might not find the European pair nearly so much alike. A recent guide (Peterson et al., 1954) distinguishes *D. major* from *D. minor* "by black back with large white shoulder patches and crimson under tail coverts," alike in both sexes. If these striking color patterns of red, black, and white have evolved for any particular reason, it may be that they serve as a warning coloration in association with aggressive habits and the guarding of stores of food within special territories, both for the Great Spotted (Pynnönen, 1939) and Red-headed Woodpeckers (*Melanerpes erythrocephalus*) (Kilham, 1958).

It will take years of observations on local populations of Hairy Woodpeckers to understand the totality of their behavior, of which their reproductive behavior forms only a part. No one description is likely to fit over the entire range. It is hoped, however, that continuing studies on agonistic and nesting behavior of *D. villosus* in relation to environment will permit further interpretations as well as extend observations given above.

SUMMARY

Observations on Hairy Woodpeckers indicate that the breeding season begins in January when the male starts coming to the female's territory, in which nesting eventually takes place after nearly 3 months of preliminary courtship. Courtship activities vary in extent and pattern from pair to pair. The basic forms are precopulatory behavior, intimate notes, display flights, duets of drumming, and tapping before symbolic or potential

nest sites, in all of which the female often takes the lead. As nest holes near completion in late April, males take the lead in copulatory behavior, often drumming to attract their mates. Two pairs of Hairy Woodpeckers which nested in adjacent territories in 1964 and 1965 are described in detail to bring out differences in behavior which may occur among individuals. A final discussion centers on the comparative behavior of woodpeckers.

LITERATURE CITED

BENT, A. C.

- 1939 Life histories of North American woodpeckers. *U.S. Natl. Mus. Bull.*, 174.

BLUME, D.

- 1963 Die Buntspechte. A. Ziemsen Verlag, Wittenburg.

COBB, S.

- 1960 Observations on the comparative anatomy of the avian brain. *Perspectives in Biology and Medicine*, 3:383-408.

HEINROTH, O., AND K. HEINROTH

- 1958 The birds. Univ. Michigan Press, Ann Arbor.

HOWARD, L.

- 1952 Birds as individuals. Collins, London.

HUXLEY, J. S.

- 1942 Evolution: the modern synthesis. Allen and Unwin, London.

KILHAM, L.

- 1956 Breeding and other habits of Casqued Hornbills (*Bycanistes subcylindricus*). *Smithsonian Misc. Collections*, 131:vi + 1-45.
- 1958 Territorial behavior of wintering Red-headed Woodpeckers. *Wilson Bull.*, 70:347-358.
- 1959a Early reproductive behavior of flickers. *Wilson Bull.*, 71:323-336.
- 1959b Behavior and methods of communication of Pileated Woodpeckers. *Condor*, 61:377-387.
- 1960 Courtship and territorial behavior of Hairy Woodpeckers. *Auk*, 77:259-270.
- 1961 Reproductive behavior of Red-bellied Woodpeckers. *Wilson Bull.*, 73:237-254.
- 1962a Breeding behavior of Yellow-bellied Sapsuckers. *Auk*, 79:31-43.
- 1962b Reproductive behavior of Downy Woodpeckers. *Condor*, 64:126-133.
- 1965 Differences in feeding behavior of male and female Hairy Woodpeckers. *Wilson Bull.*, 77:134-145.

PETERSON, R. T., G. MOUNTFORT, AND P. A. D. HOLLOM

- 1954 A field guide to the birds of Europe. Houghton Mifflin Co., Boston.

PYNNÖNEN, A.

- 1939 Beiträge zur Kenntnis der Biologie finnischer Spechte. *Ann. Soc. Zool.-Bot. Fennica Vanamo*, 7:1-166.
- 1943 Beiträge zur Kenntnis der Biologie finnischer Spechte, II. *Ann. Soc. Zool.-Bot. Fennica Vanamo*, 9:1-60.

SHELLEY, L. O.

- 1933 Some notes on the Hairy Woodpecker. *Bird-Banding*, 4:204-205.

SMITH, W. J.

- 1963 Vocal communication of information in birds. *Amer. Nat.*, 97:117-125.

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